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| APPLICATION NO.  | FILING DATE | FIRST NAMED INVENTOR      | ATTORNEY DOCKET NO. | CONFIRMATION NO.         |
|--|-------------|---------------------------|---------------------|--------------------------|
| 10/091,104   | 03/05/2002  | Andreas Nikolaos Matzakos | TH-1759 (US)        | 5899                     |
| 7590   | 05/05/2004  |                           | EXAMINER            | MEDINA SANABRIA, MARIBEL |
| Jennifer D. Adamson<br>Shell Oil Company<br>Legal - Intellectual Property<br>P.O. Box 2463<br>Houston, TX 77252-2463 |             |                           | ART UNIT            | PAPER NUMBER             |
|  |             |                           | 1754                |                          |
| DATE MAILED: 05/05/2004  |             |                           |                     |                          |

Please find below and/or attached an Office communication concerning this application or proceeding.

| <b>Office Action Summary</b> | <b>Application No.</b> | <b>Applicant(s)</b> |
|------------------------------|------------------------|---------------------|
|                              | 10/091,104             | MATZAKOS ET AL.     |
| Examiner                     | Art Unit               |                     |
| Maribel Medina               | 1754                   |                     |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

1)  Responsive to communication(s) filed on 02 August 2002.

2a)  This action is **FINAL**.                    2b)  This action is non-final.

3)  Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

4)  Claim(s) 1-130 is/are pending in the application.  
4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.

5)  Claim(s) 41,45,46,49,50,53-61,63-71,87-123,125,126 and 128 is/are allowed.

6)  Claim(s) 1-3,9-34,39,42-44,47,48,51,52,62,72-86,127,129 and 130 is/are rejected.

7)  Claim(s) 4-8,35-38 and 124 is/are objected to.

8)  Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

9)  The specification is objected to by the Examiner.

10)  The drawing(s) filed on 02 August 2002 is/are: a)  accepted or b)  objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)  The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)  Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a)  All b)  Some \* c)  None of:  
1.  Certified copies of the priority documents have been received.  
2.  Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3.  Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1)  Notice of References Cited (PTO-892)  
2)  Notice of Draftsperson's Patent Drawing Review (PTO-948)  
3)  Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 8/16/02.  
4)  Interview Summary (PTO-413)  
Paper No(s)/Mail Date.       .  
5)  Notice of Informal Patent Application (PTO-152)  
6)  Other:       .

**DETAILED ACTION**

**Claim Objections**

1. Claims 6, 29, 40, 62 and 124 are objected to because of the following informalities:
  - a. Claim 6, depends from itself. Appropriate correction is required.
  - b. In claim 29, "then" should be changed to --the--.
  - c. In claim 40, line 33, "combustors" should be changed to --combustion heaters-- as in line 15 of the instant claim.
  - d. In page 78, there are two claims 62, for purposes of this Office Action; the first claim 62 has been renumbered as claim 61. However appropriate correction is required in the response to this Office Action.
  - e. In claim 124, line 2; "steam" should be changed to --stream--.

Appropriate correction is required.

**Claim Rejections - 35 USC § 112**

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
3. Claims 2, 9-13, 18, 20, 22, 25, 31, 42-44, 47, 48, 51, 52, 62, 72-86 and 129 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
  - a. Claims 2, 42, and 51 are indefinite and unclear, since the claims include, methanol, ethanol, hydrogen and carbon monoxide as part of the Markush group describing the possible vaporizable hydrocarbon, however, these are not hydrocarbons. It is suggested to delete these components from the Markush group.

- b. In claim 9, the term “the diffusion of hydrogen” lack antecedent basis.
- c. Claims 12, is indefinite and unclear since the claim include, methanol, as one of the options for a vaporizable hydrocarbon, however, methanol is not a hydrocarbon.
- d. In claim 30, the term “the nitrogen oxide formation” lack antecedent basis.
- e. In claim 44, lines 8, 12 and 13 the term “said heating section” lack antecedent basis.
- f. Claim 66 is indefinite and unclear, for use of improper Markush language. The claim should be changed to read --selected from the group consisting of oxides, carbides, and nitrides of Group III A, III B, IVA, IV B and Group VIII metals of the Periodic Table. --

- g. Claim 72 is indefinite and unclear since the claim recites that the vaporizable hydrocarbon is syngas. However, syngas is not and hydrocarbon.
- h. Claims 81 and 83 are indefinite and unclear, for use of improper Markush language. The phrase that reads --the group consisting of-- should be inserted after “selected from”.
- i. Claim 129 is indefinite and unclear, for use of improper Markush language. The claim should be changed to read --selected from the group consisting of production of urea, building materials, food products and carbonate drinks. --
- j. In claim 130, line 3, the term “the heating zone” lack antecedent basis.

**Claim Rejections - 35 USC § 102**

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) The invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1-3, 11, 12, 14-21, 23-31, 34, 39, and 129 are rejected under 35 U.S.C. 102(b) as anticipated by US Patent Number 5,997,594 (Edlund et al).

Edlund et al disclose a process for the production of hydrogen, comprising: a) reacting steam with a vaporizable hydrocarbon in a reaction zone containing a reforming catalyst to produce a mixture of hydrogen, carbon monoxide and carbon dioxide at a temperature in the range from 250 to 600°C and a pressure in the range from 6 to 20 atm (See col. 2, lines 17-23 and col. 7, lines 23-54); b) providing heat to the reaction zone by employing a heating element including an oxidation catalyst (instantly claimed flameless distributed combustion) surrounding at least a portion of the reaction zone (See col. 2, lines 52-58); and c) conducting the reaction in the vicinity of a hydrogen-permeable and hydrogen-selective membrane, whereby hydrogen formed in the reaction zone permeates through said selective membrane and is separated from the carbon monoxide and carbon dioxide (See col. 2, lines 23-26). The hydrogen produced and separated therein is a fed to a typical fuel cell (See col. 7, lines 55-60; and col. 21, lines 39-49). The vaporizable hydrocarbon can be an alcohol vapor, such as methanol, or a hydrocarbon vapor, such as propane, among others (See col. 2, lines 18-21). The membrane can be any hydrogen-selective and permeable membrane such as porous ceramics, porous carbon, porous metals, and palladium containing alloys, such as Pd-25 % Ag, Pd-40%Cu, on a support (See col.

8, line 65 to col. 9, line 5; col. 16, lines 50-55; and col. 22, lines 44-67). The reforming catalyst may be any known reforming catalyst such as nickel on alumina and copper on zinc (See col. 25, lines 47-50). No difference is seen between the instantly claimed invention and Edlund et al disclosure.

6. Claims 1-3, 9-16, 18, 19, 21-30, 32-34, 129 and 130 are rejected under 35 U.S.C. 102(b) as anticipated by US Patent Number 5,639,431 (Shirasaki et al).

Shirasaki et al disclose a process for the production of hydrogen, comprising: a) reacting steam with a vaporizable hydrocarbon in a reaction zone containing a reforming catalyst to produce a mixture of hydrogen, carbon monoxide and carbon dioxide at a temperature in the range from 500 to 600°C (See col. 8, lines 60-65); b) providing heat to the reaction zone by employing a heating element including a combustion catalyst (instantly claimed flameless distributed combustion) surrounding at least a portion of the reaction zone (See col. 12, lines 1-6); and c) conducting the reaction in the vicinity of a hydrogen-permeable and hydrogen-selective membrane, whereby hydrogen formed in the reaction zone permeates through said selective membrane and is separated from the carbon monoxide and carbon dioxide (See col. 8, lines 36-41). The hydrogen produced and separated therein is a fed to a typical fuel cell (See col. 1, lines 4-20). The vaporizable hydrocarbon can be naphtha; natural gas and town gas (See col. 12, lines 13-15). The membrane can be any hydrogen-selective and permeable membrane such as porous ceramics, porous carbon, porous metals, and palladium containing alloys, on a support (See col. 98, lines 40-51, and col. 11, lines 8-15). The reforming catalyst may be any known reforming catalyst such as nickel on alumina and copper on zinc. Shirasaki et al disclose the use

of a sweep gas to remove the hydrogen from the hydrogen-permeable membrane. No difference is seen between the instantly claimed invention and Shirasaki et al disclosure.

**Allowable Subject Matter**

7. Claims 4-8, and 35-38 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

8. Claims 40, 42-44, 47, 48, 51, 52, 62, 72-86, 124 and 127 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, and objections set forth in this Office action.

9. Claims 41, 45, 46, 49, 50, 53-60, 63-71, 87-123, 125, 126, and 128 have been allowed.

10. The following is a statement of reasons for the indication of allowable subject matter:

Claims 4-8 disclose allowable subject matter. The prior art fails to disclose or suggest, the step of “passing fuel gas through a plurality of tubes in the heating zone, said tubes having openings sized and spaced to controls the quantity of fuel gas mixed with oxidant at various points along the heating zone”.

Claims 35-38 disclose allowable subject matter, the prior art fails to disclose or suggest that the fuel cell is a high pressure molten carbonate fuel cell and the non permeable by-product gases from the reaction zone are directed to the cathode of said fuel cell.”

11. The following is an examiner’s statement of reasons for allowance:

Claims 40-128 are allowable upon consideration of the prior art. The prior art fails to disclose or suggest the reactor for carrying the invention having a plurality of flameless

distributed combustion heaters. And fails to disclose or suggest the step of “directing by-product gases to the cathode of the fuel cell” (instant claim 99).

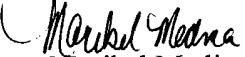
Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled “Comments on Statement of Reasons for Allowance.”

**Conclusion**

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Maribel Medina whose telephone number is (571) 272-1355. The examiner can normally be reached on Monday through Friday from 7:30 AM to 4:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Stanley Silverman can be reached on (571) 272-1358. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

  
Maribel Medina  
Examiner  
Art Unit 1754